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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,154	01/23/2002	Vincent Fortin	M12524 US	2279

7590

12/04/2002

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EXAMINER
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LEE, HSIEN MING

ART UNIT	PAPER NUMBER
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2823

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DATE MAILED: 12/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/056,154

Applicant(s)

FORTIN ET AL.

Examiner

Hsien-Ming Lee

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 18 September 2002.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 and 3-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-7 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Remarks*

1. The objection to claims 1 and 6 and the 112-second-paragraph rejection to claim 3 are withdrawn in response to applicant's amendment filed 9/18/02.
2. Applicant's cancellation to claim 2 is acknowledged. Claims 1 and 3-7 are pending in the application.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3, 4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blair (US 6,136,705) in view of Venkartraman et al.(US 6,093,966) and Chiang et al. (US 2002/0132473 ).

In re claims 1, 4 and 7, Blair teaches the claimed method for forming cobalt silicide on a body 110 which has a surface that comprises silicon (Fig.4), the method comprising:

- forming a cobalt layer 118 on the surface (Fig.5);
- forming a titanium layer 120 (thickness : 50~200 Å) over the cobalt layer 118 (Fig.6), wherein the titanium layer 120 is deposited on the cobalt layer 118 to be in contact with the cobalt layer 118;

- reacting the cobalt layer 118 with the silicon 110 to form cobalt silicide 122/124/126 (Fig.8) and
- removing the titanium layer 120 and un-reacted cobalt layer 118 (Fig.9).

Blair fails to teach utilizing an ionized physical vapor deposition (IPVD) for forming the titanium layer while the body is attached to a support biased with an AC power of 0 W.

However, using the IPVD for forming titanium layer is a well-known method, as evidenced by Venkartraman et al. Particularly, Venkartraman et al. teach utilizing the IPVD for forming the titanium layer (col.5, lines 28-38), wherein the forming step is performed at the bias power of close to zero W (col.5, lines 48-50) for the purpose of preventing the adjacent layers from damage (col.6, lines 4-6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to utilize the IPVD method with the body attaching to a support biased with a power of 0 W as taught by Venkartraman et al. for forming the titanium layer of Blair since by doing so it would provide improve layer thickness control and prevent the underlying layers from damage.

Still, the combined teachings of Blair and Venkartraman et al. do not expressly teach that the power source is AC. However, Chiang et al. teach that the bias power source is typically an AC source ( section [0032]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to form the titanium layer of Blair utilizing the IPVD method with the body attaching to a support biased with a power of 0 W as taught by Venkartraman et al., wherein the

Art Unit: 2823

bias power can be the AC source as taught by Chiang et al., since this is a typical operation in IPVD method.

In re claim 3, the selection of the distance between the target and the body is obvious because it is a matter of determining optimum process condition by routine experimentation. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious). In such situation, applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results. See M.P.E.P. 2144.05 III.

5. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blair (US '705) in view of Venkartraman et al.(US '966) and Chiang et al. (US '473 ) as applied to claims 1, 3-4 and 7 above, and further in view of Venkatesan et al. (US 5,863,598) and Givens (US 2002/0019127).

In re claim 5, the combined teachings of Blair, Venkartraman et al and Chiang et al. substantially teaches the claimed method except that the silicon surface is located at a bottom of an opening having an aspect ration of at least 2.5.

However, Venkatesan et al. teach forming a high-aspect- ratio contact having a silicon layer 112 filling in an opening having aspect ration of at least 2.5 (Fig.1c and col. 1, lines 20-22; col.3, lines 46-49).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to form layers of Blair, Venkartraman et al and Chiang et al., including the silicon body, the cobalt layer and the titanium layer using the IPVD method in the high-aspect-

ratio contact structure of at least 2.5 as taught by Venkatesan since by doing so it would provide a contact structure having a good coverage without void formation.

In re claim 6, the combined teachings of Blair, Venkartraman et al, Chiang et al. and Venkatesan et al. still fail to teach that at least part of a sidewall surface of the opening is made of a dielectric.

However, Givens, in a method of forming a high-aspect-ratio contact, teaches forming a high-aspect ratio opening 18 in a dielectric layer 16 formed on a substrate 12 (Fig.5); forming a cobalt layer 30 in the opening 18 (Fig.5); and forming a cobalt silicide 32 in the opening 18 (Fig.9).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to form the cobalt silicide of Blair, Venkartraman et al, Chiang et al. and Venkatesan et al. in the high-aspect-ratio opening, wherein the opening is formed in the dielectric layer having the sidewall as taught by Givens, since by this manner it would provide a good electrical insulation between the substrate and the subsequent layers formed on the dielectric layer.

### ***Conclusion***

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after


the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-0142 for regular communications and 703-305-0142 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
Hsien Ming Lee  
November 23, 2002

  
Olik Chaudhuri  
Supervisory Patent Examiner  
Technology Center 2800